PAST CE BOARD EXAM:

From the figure shown, the thickness of a permeable soil layer is 1.1m making an angle of 14degrees with the horizontal.

$k = 4.87x10^{-2} cm/sec$

1) Compute the hydraulic gradient
2) Compute the cross-sectional area at right angles to the cross-section shown
3) Compute the flow rate in m^3/hr/m.

SOLUTION:

$$cos14 = \frac{36}{L}$$

$$L = 37.10m$$

Hydraulic gradient

$$i = \frac{h}{L} = \frac{1.4}{37.10} = \mathbf{0.038}$$

Cross-sectional area at right angles to the cross-section

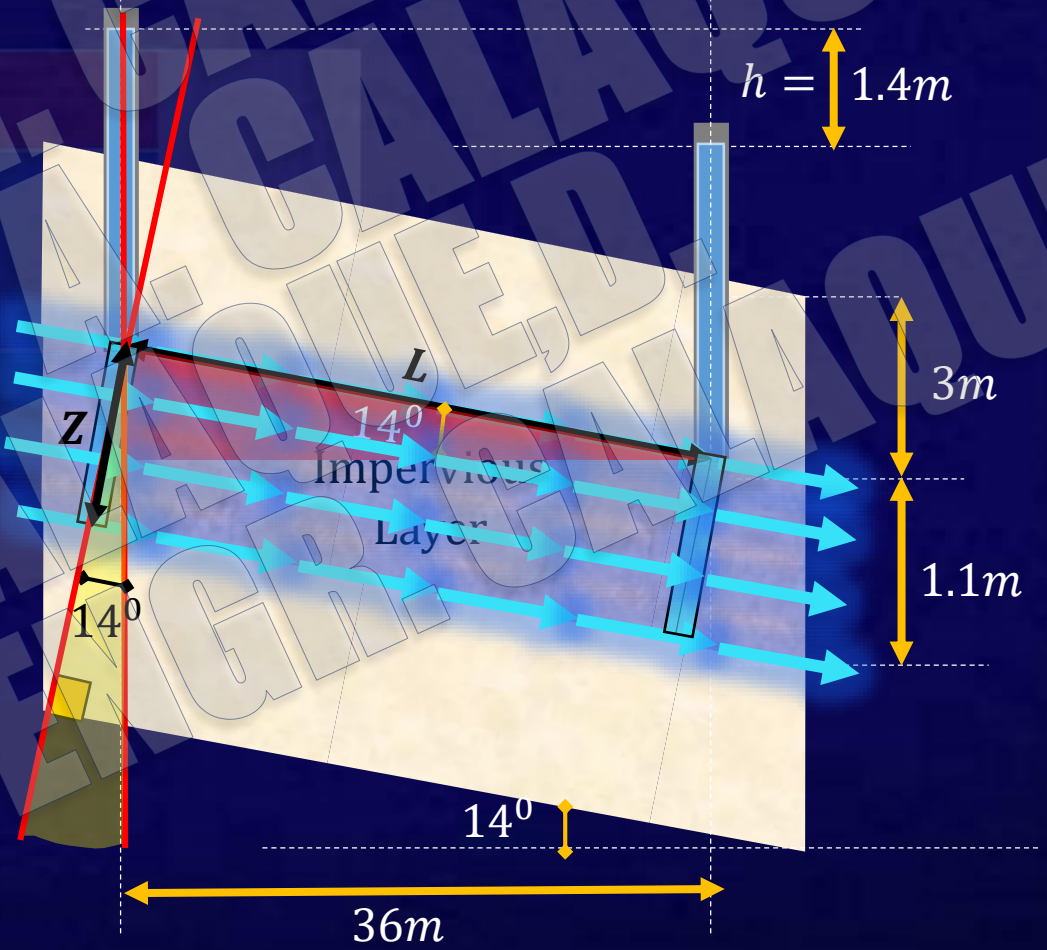
Take 1m width

$$A = Z(1m) = 1.1cos14^0$$

$$A = 1.067m^2$$

$$cos14 = \frac{Z}{1.1}$$

$$Z = 1.1 \cos 14^0$$



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PAST CE BOARD EXAM:

From the figure shown, the thickness of a permeable soil layer is 1.1m making an angle of 14degrees with the horizontal.

$k = 1.7532\ m/hr$

Compute the hydraulic gradient

1) Compute the cross-sectional area at right angles to the cross-section shown
2) Compute the flow rate in m^3/hr/m.

SOLUTION:

Hydraulic gradient

$$i = \frac{h}{L} = \frac{1.4}{37.10} = \mathbf{0.038}$$

Cross-sectional area at right angles to the cross-section

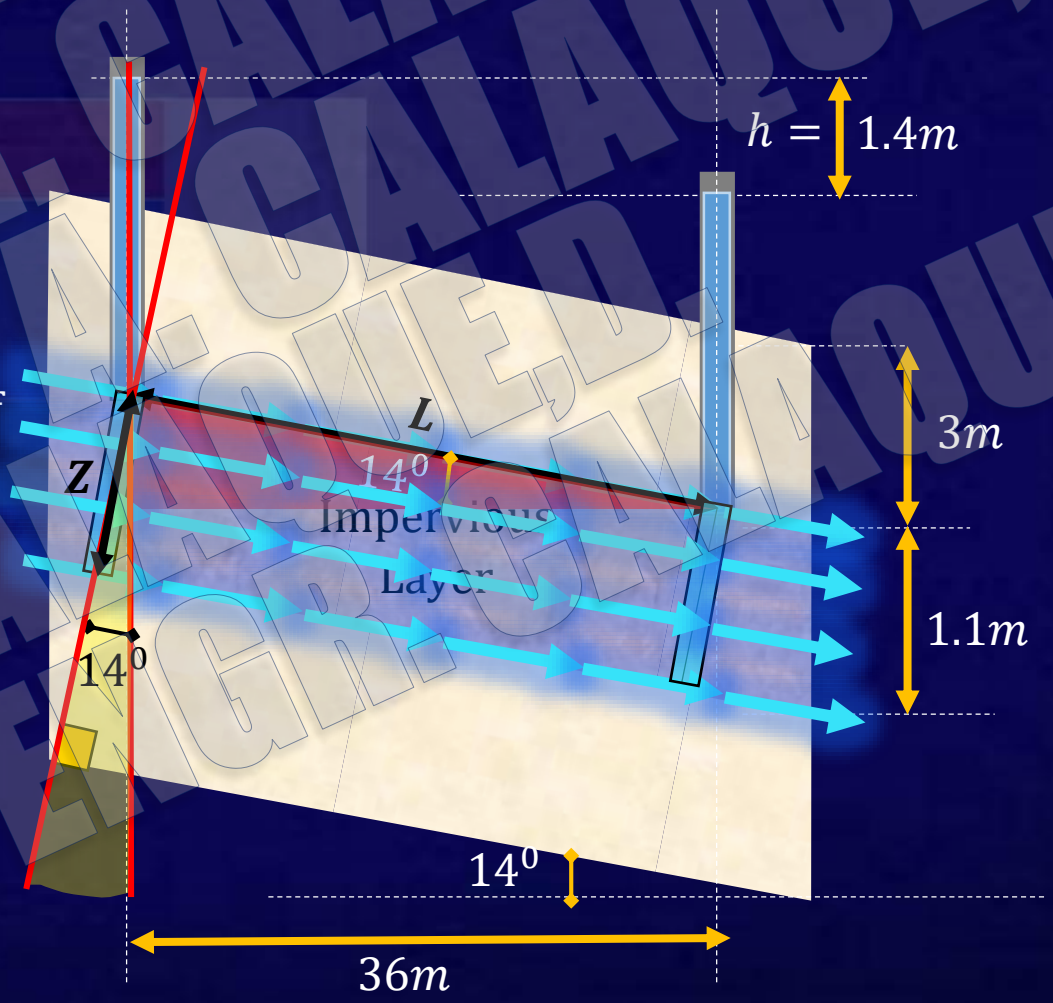
$A = 1.067m^2$

Flow Rate

$Q = kiA$

$Q = 1.7532(0.038)(1.067)$

$\boldsymbol{Q = 0.071\ m^3/hr}$ **per m.**



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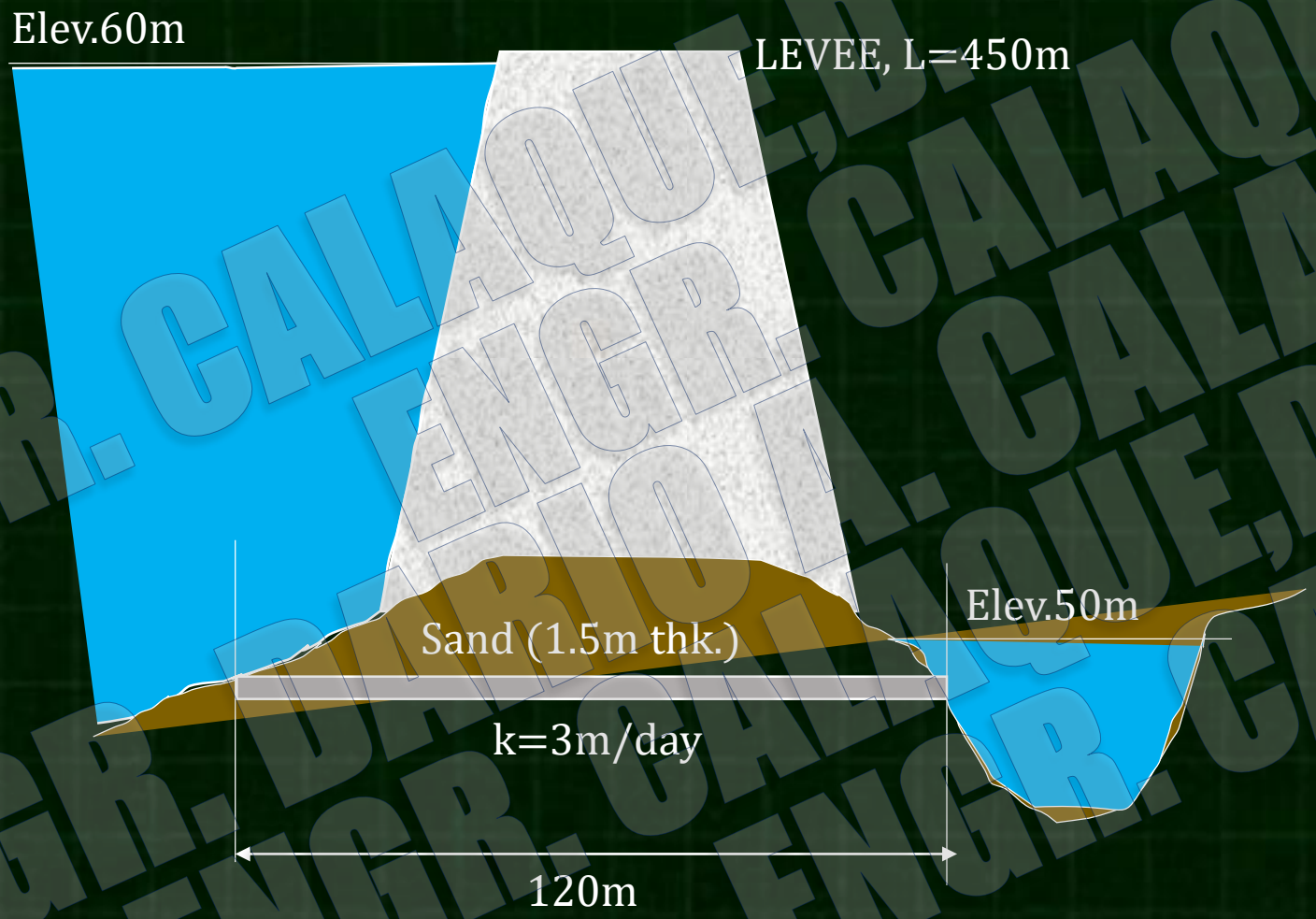
PAST CE BOARD EXAM:

For a given flood control, levee system as shown. Determine the total discharge in liters per sec.



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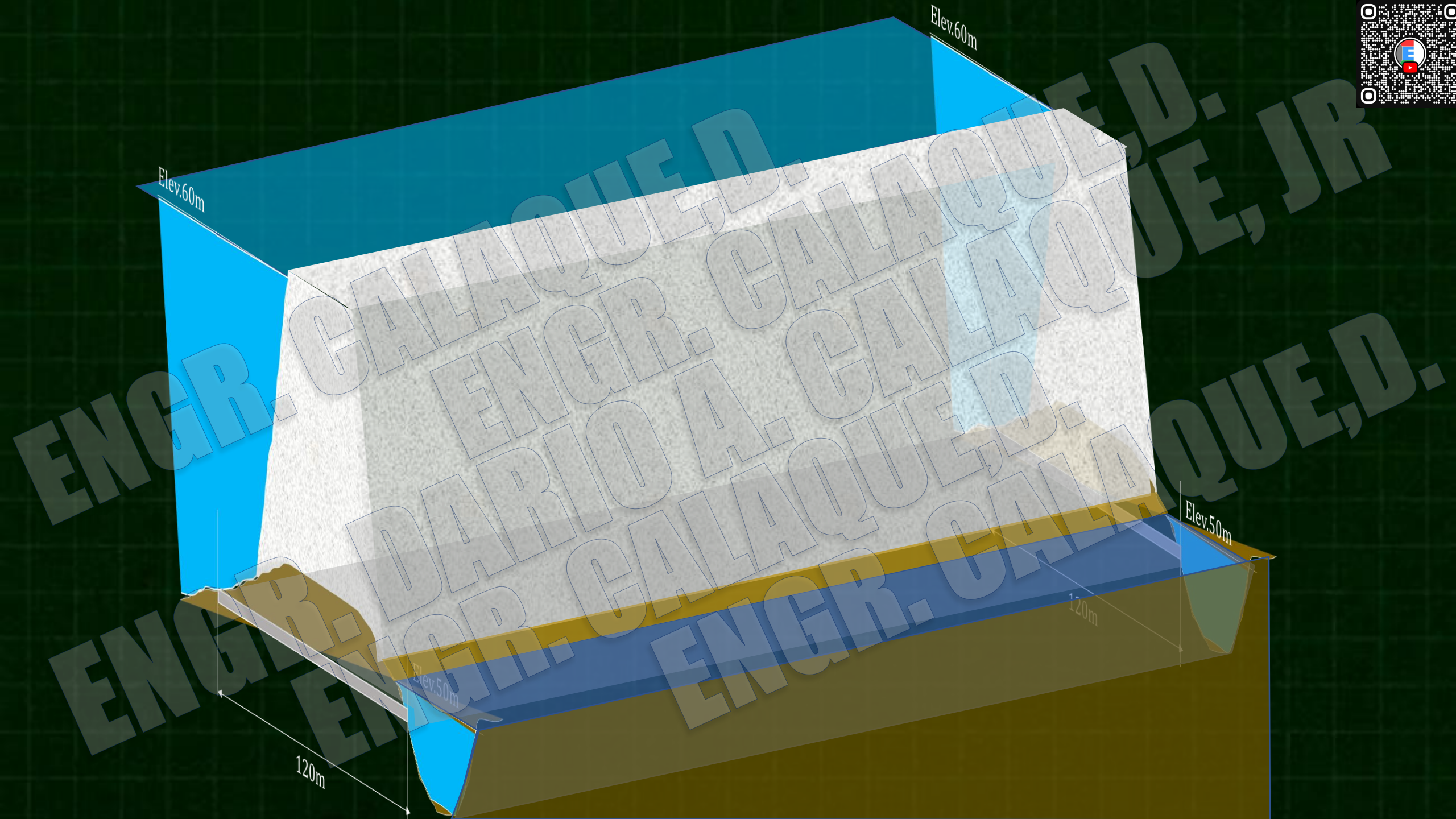

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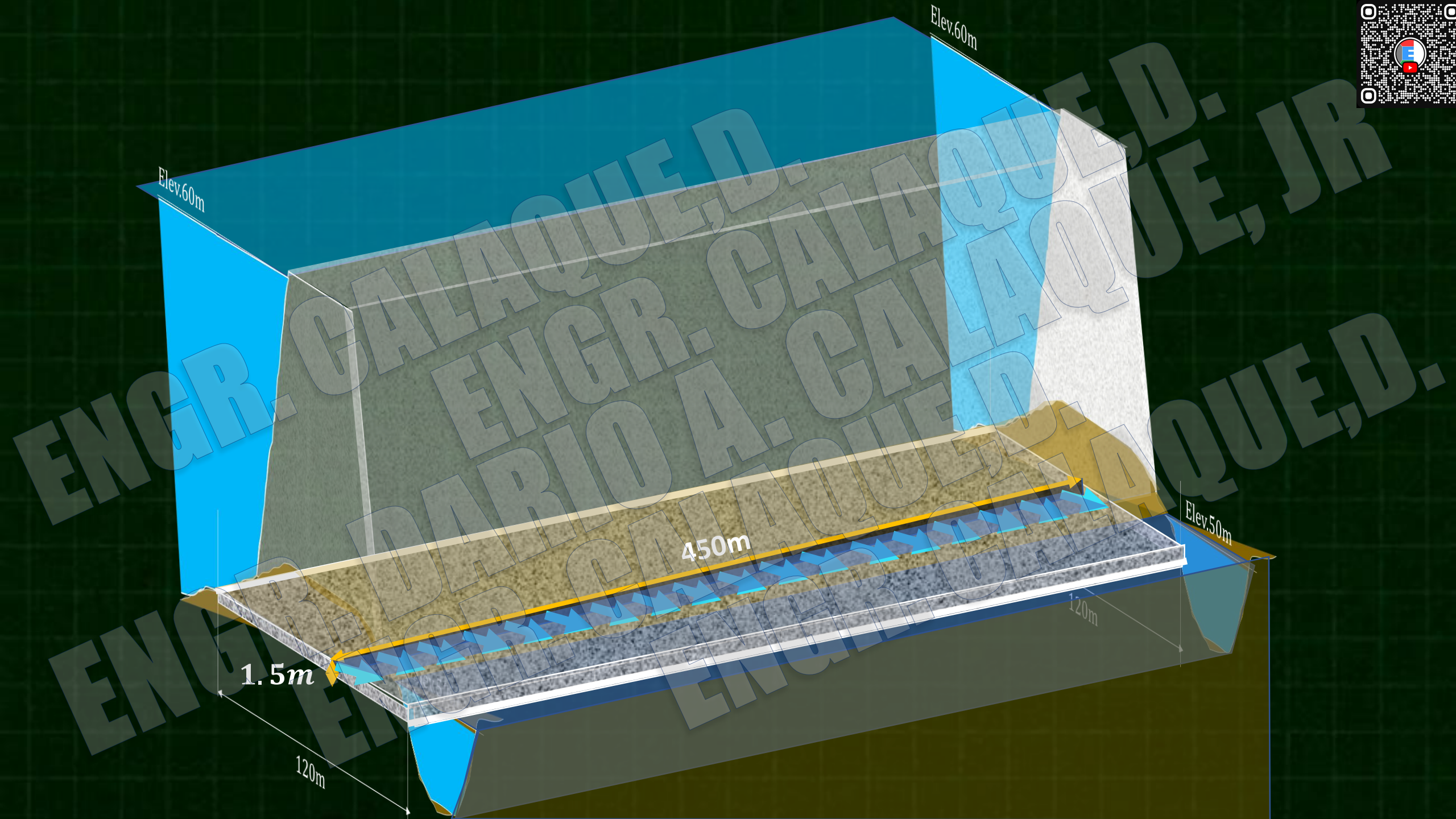

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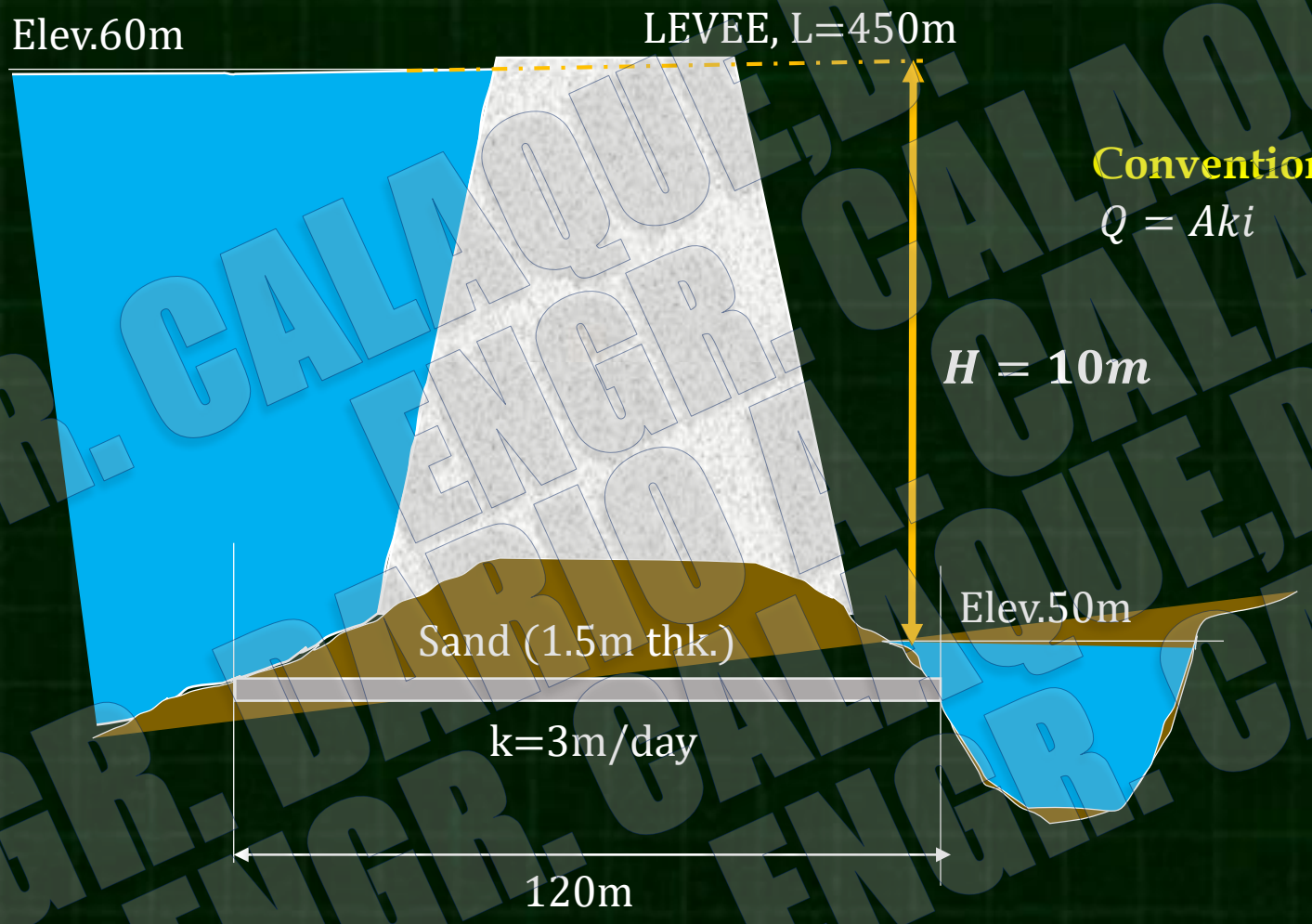
PAST CE BOARD EXAM:

For a given flood control, levee system as shown. Determine the total discharge in liters per sec.



Conventional Solution:

$Q = Aki$

$$Q = (1.5m\ x\ 450m)\left(3\frac{m}{day}\right)\left(\frac{10m}{120m}\right)\left(\frac{1000li}{1m^3}\right)\left(\frac{1d}{24h}\right)\left(\frac{1h}{3600s}\right) = 1.95li/s$$

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In a laboratory, a constant head permeability test was conducted on a brown sand with the trace of mica. The following data were obtained:

Quantity of water discharged during the test = 250cc

Length of specimen between manometer outlets = 11.43cm

Time required for a given quantity of water to be discharged = 65sec

Head difference between manometer levels = 5.5cm

Diameter of specimen = 10.16cm

1) Compute the coefficient of permeability in cm/sec

a) 0.0986cm/s

b) 0.0145cm/s

c) 0.0556cm/s

d) 0.0205cm/s

2) Compute the discharged velocity in cm/sec

a) 0.0323cm/s

b) 0.0474cm/s

c) 0.0565cm/s

d) 0.003cm/s

3) If the viscosity of water is 0.0684 x 10^-4 g-sec/cm^2, compute for the absolute permeability in cm^2

a) 6.74 x 10^-7 sq.cm

b) 8.74x 10^-7 sq.cm

c) 9.74 x 10^-7 sq.cm

d) 5.74 x 10^-7 sq.cm

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PROBLEM 1:

For a constant laboratory permeability test on a fine sand, the following are given

Length of specimen = 17 cm
Dia. of specimen = 5.5 cm
Constant head difference = 40 cm
Wt. of water collected = 50 g
Duration of water collection = 12 sec

Find the hydraulic conductivity

a. 0.0475 cm/sec b. 0.0745cm/sec
c. 0.0547 cm/sec d. 0.0345 cm/sec

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PROBLEM 2:

During a constant head permeability test on a sample of sand, 150 cm^3 of water were collected in 2 min. The sample had a length of 10 cm and a diameter of 2 in. The head was maintained at 20 cm. Compute the coefficient of permeability.

a. 0.0404 cm/s b. 0.0308 cm/s
c. 0.5046 cm/s d. 0.0215 cm/s

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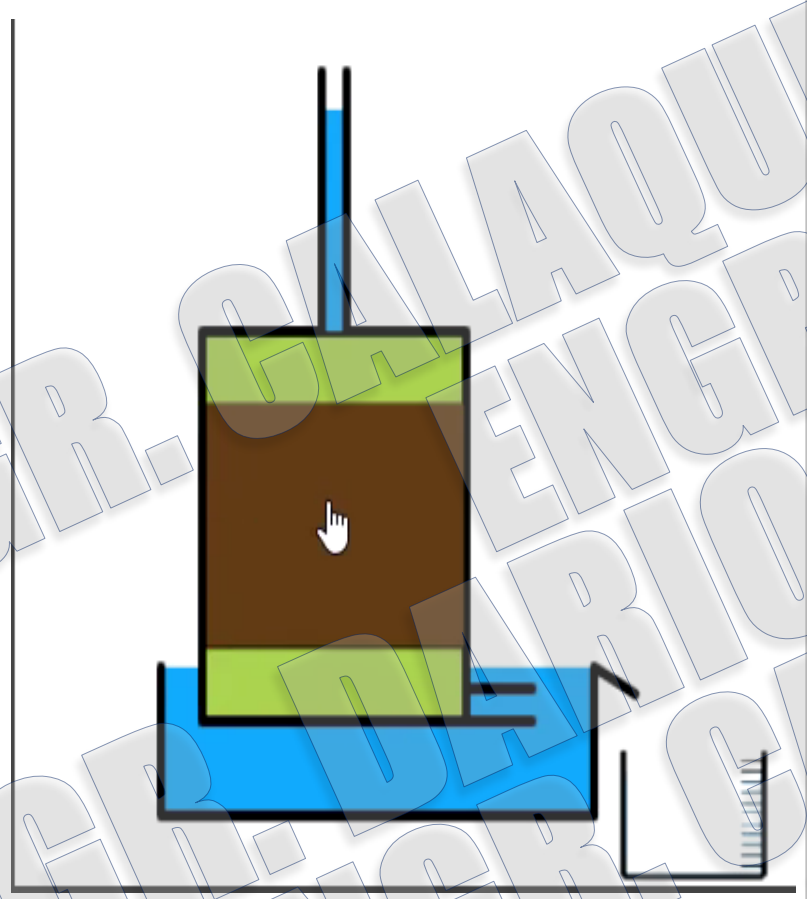
EXAMPLE



Calculate for the measurement of the permeability of a clay lining canal, as the following values were obtained:

a = 0.26 sq. in

A = 153.20 sq. in.

t = 6.2 hr.

L = 5.16 in.

h_1 = 66.1 in.

h_2 = 59.1 in.

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SOLUTION

Calculate for the measurement of the permeability of a clay lining canal, as the following values were obtained:

- a = 0.26 sq. in A = 153.20 sq. in.
- t = 6.2 hr. L = 5.16 in.
- h_1 = 66.1 in. h_2 = 59.1 in.

Solution:

$$k = \frac{2.303aL}{At} \log_{10} \frac{h_1}{h_2} = \frac{2.303 \times 0.26 \times 5.16}{153.2 \times 6.2} \times \log_{10} \frac{66.1}{59.0} = 1.6 \times 10^{-4} \text{ in/hr.}$$

Another Solution:

$$k = \frac{aL}{At} \ln\left(\frac{h_1}{h_2}\right) = \frac{0.26(5.16)}{(153.20)(6.2)} \ln\left(\frac{66.1}{59.1}\right) = 0.00016 = 1.6x10^{-4} in/hr$$

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TEST YOURSELF

The data from a falling head test are as follows:
Diameter of standpipe = 0.6cm
Initial Head = 92cm
Final Head = 85cm
Duration of test = 12min
Length of soil sample = 30cm
Diameter of permeameter = 40cm
Determine the coefficient of permeability in cm/min at 20deg.Celsius.

a) 1.45 x 10^-5cm/min
b) 2.45 x 10^-5cm/min
c) 3.45 x 10^-5cm/min
d) 4.45 x 10^-5cm/min ANS

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TEST YOURSELF

A 3.5m thick silty sand intersects one side of the reservoir. The strata has a hydraulic conductivity of 5x10^-2 cm/s and extends along the entire 800m length of the reservoir. An observation well has been installed in this strata. Compute the seepage loss from the reservoir through this strata in liters per day.

a) 1,412,832 liters/day
b) 1,312,832 liters/day
c) 1,212,832 liters/day
d) 1,112,832 liters/day ANS

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A confined aquifer has a source of recharge as shown. The hydraulic conductivity of the aquifer is 40 m/day and its porosity is 0.25. The piezometric head in the two wells 1000 m apart is 75 m and 65 m respectively from a common data. The average thickness of the aquifer is 20 m and the average width is 4 km.

8. Compute the rate of flow of through the aquifer in m^3/day.

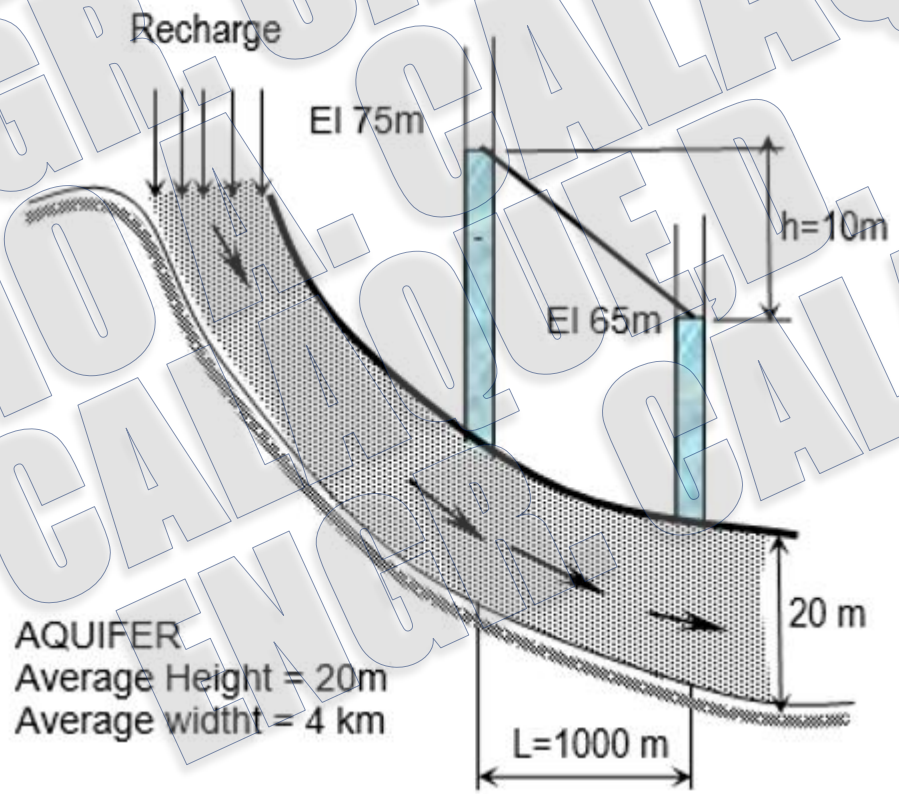
a. 29000 m3/day
b. 540000 m3/day
c. 42000 m3/day
d. 32000 m3/day

9. Compute the seepage velocity.

a. 1.6 m/day
b. 0.98 m/day
c. 2.2 m/day
d. 3.13 m/day

10. Compute the time of travel from the head of the aquifer to a point 4 km downstream in days.

a. 3200 days
b. 4300 days
c. 2500 days
d. 1700 days



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PAST CE BOARD EXAM:

Determine the equivalent coefficient of permeability for flow in:

a. Horizontal direction

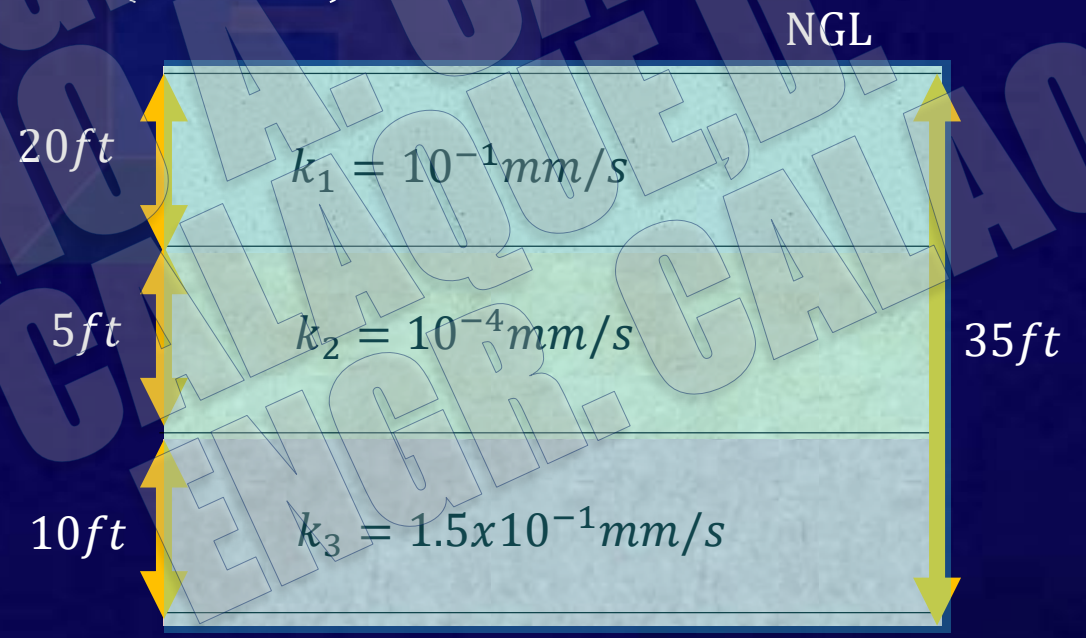
b. Vertical direction

Equivalent Coefficient of Permeability in Horizontal Flow

$$K_{H\,eq.}T = \sum kt$$

$$35K_{H\,eq.} = 20(10^{-1}) + 5(10^{-4}) + 10(1.5x10^{-1})$$

$$K_{H\,eq} = \mathbf{0.10mm/s}$$



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PAST CE BOARD EXAM:

Determine the equivalent coefficient of permeability for flow in:

a. Horizontal direction

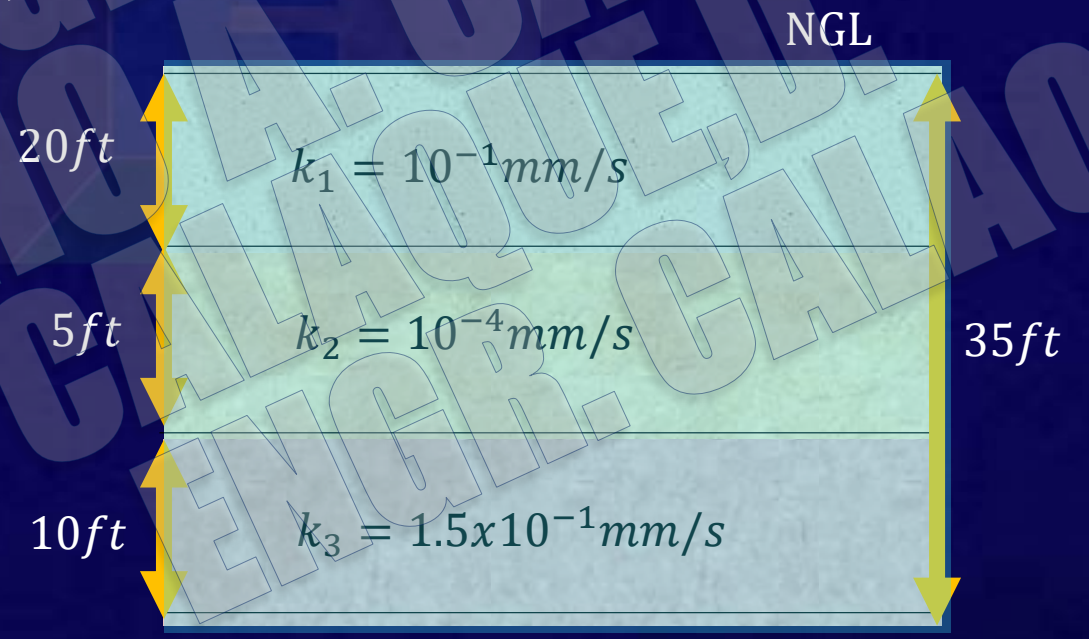
b. Vertical direction

Equivalent Coefficient of Permeability in Vertical Flow

$$\frac{T}{K_{V\,eq}} = \sum \frac{t}{k}$$

$$\frac{35}{K_{v\,eq.}} = \frac{20}{(10^{-1})} + \frac{5}{(10^{-4})} + \frac{10}{(1.5x10^{-1})}$$

$$K_{v\,eq} = \mathbf{0.00069mm/s}$$



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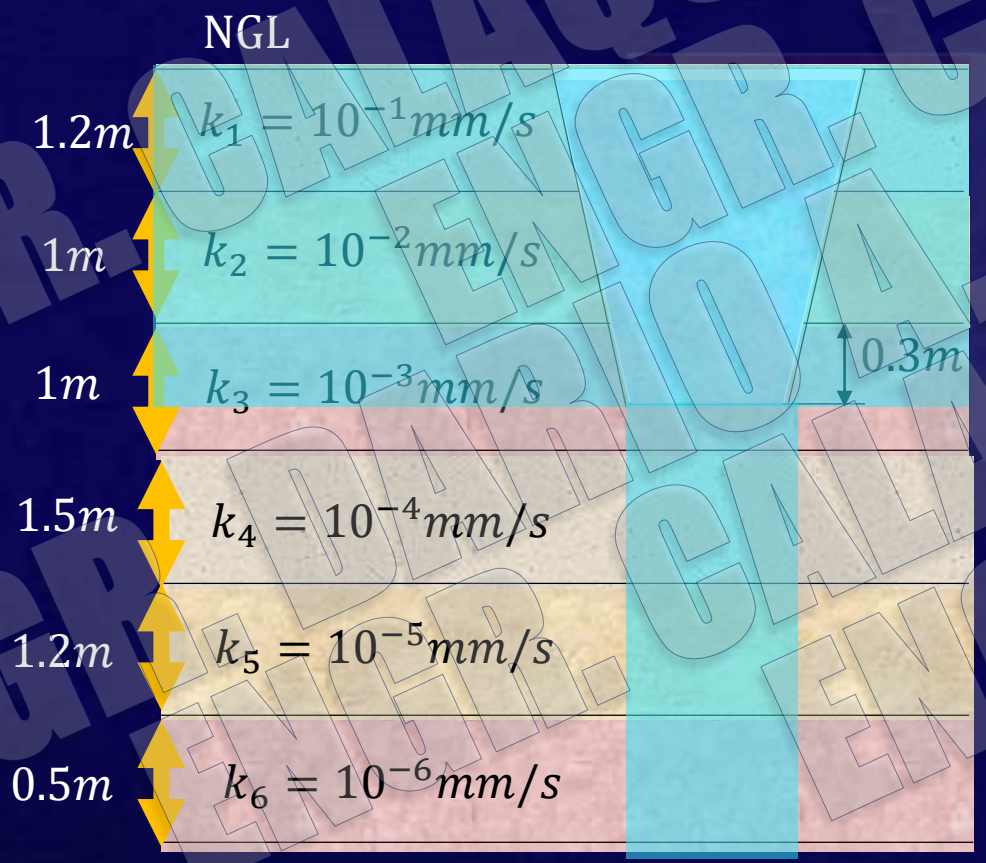
PAST CE BOARD EXAM: For a given soil profile of a canal as shown in the figure. Determine the following:

a. Equivalent coefficient of permeability in horizontal direction on sides of canal.

b. Equivalent coefficient of permeability in vertical direction on the bottom of canal.



Equivalent Coefficient of Permeability in Horizontal Flow

$$K_{H\,eq}.T = \sum tk$$

$$(1.2 + 1 + 0.3)K_{H\,eq.} = 1.2(10^{-1}) + 1(10^{-2}) + 0.3(10^{-3})$$

$$K_{H\,eq} = \mathbf{0.05mm/s}$$

Equivalent Coefficient of Permeability in Vertical Flow

$$\frac{T}{K_{V\,eq}} = \sum \frac{t}{k}$$

$$\frac{(0.7+1.5+1.2+0.5)}{K_{v\,eq.}} = \frac{0.7}{(10^{-3})} + \frac{1.5}{(10^{-4})} + \frac{1.2}{(10^{-5})} + \frac{0.5}{(10^{-6})}$$

$$K_{v\,eq} = \mathbf{0.00000613497mm/s}$$

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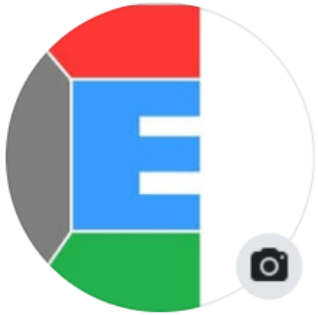

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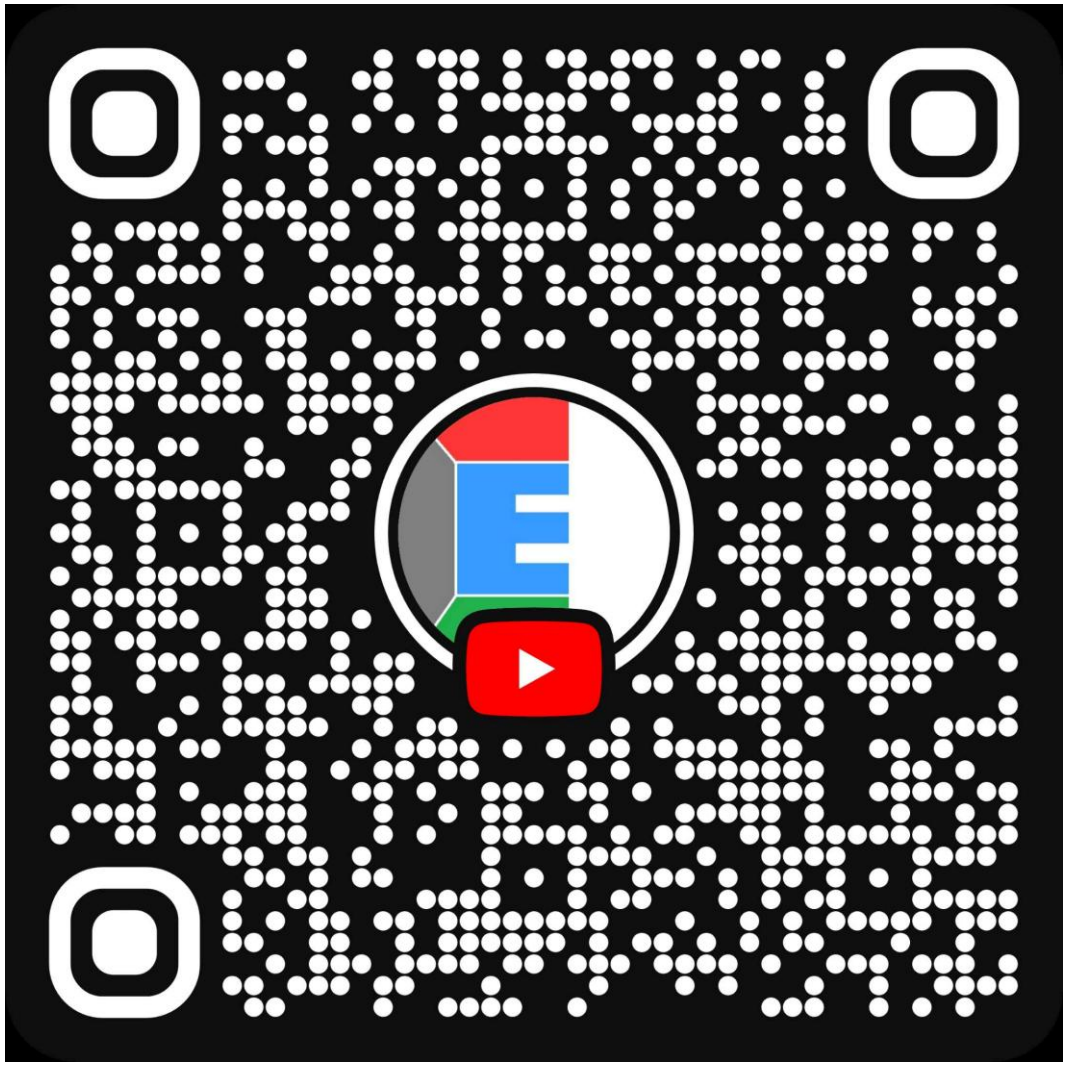

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